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Entitled

THERMAL AND STRUCTURAL CHARACTERIZATION OF MACRO-ENCAPSULATED PHASE CHANGE MATERIAL INTEGRATED INTO CONCRETE CUBES

by

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Date & Venue

6:00 PM
Sunday, 22 April 2018
Room 043, F3 Building

Abstract

The main scope of this research is to develop thermally enhanced geopolymer concrete by incorporating phase change material (PCM). One of the main objectives of this work was to encapsulate the PCM into porous matrices of lightweight expanded clay aggregate and polyurethane foam. Geopolymer paste was developed and applied around these matrices to prevent leakage of liquidous PCM hence producing form-stable PCM capsules. Efficacy of the capsules were confirmed by rapid thermal cycling, weathering test and diffusion-ooze circle test. The capsules were integrated in different volume ratio into the geopolymer to cast concrete cubes. Thermal performance of the composite concrete cubes was measured using a customized indoor set-up. Results revealed that the addition of PCM capsules decreased the back-surface temperature of concrete cubes. A maximum temperature drop of 12.5 °C at the back surface was attained using 75% PCM capsules of foam. Compressive tests were conducted which revealed the considerable drop in compressive strength. However, the produced concrete composites can be used for building facades and roofing membranes.

Keywords: Geopolymer concrete, phase change material, light weight expanded clay aggregate, polyurethane foam, peak temperature damping.